

REMARKS

This Amendment is filed in response to the Office Action mailed on January 10, 2005. All objections and rejections are respectfully reversed.

Election/Restriction Requirement

At paragraphs 1-8, the Examiner stated certain newly added claims were directed to an invention that is independent or distinct from the invention originally claimed. Claims 1-22, 38, 40, 41, 43, 44, and 46 are in group I. Claims 23-37, 39, 42, 45, and 47-54 are in group II. Applicant elects the claims in group I, with traverse.

§101 Rejection

At paragraphs 9-12, the examiner rejected claims 1-9, 38, 40-41, 43-44, and 46 under 35 U.S.C. §101 "because the claimed invention is directed to non-statutory subject matter."

Claims 1, 38, 40, 41, 43, 44, and 46 have been amended to overcome the rejection.

Applicant respectfully urges that claims 1, 38, 40, 41, 43, 44, and 46 are in condition for allowance, along with all claims dependent therefrom.

§102 Rejection

At page 5 of the Office Action claims 1, 3,8-12, 14-22, 38, 40-41, 43-44, and 46 were rejected under 35 U.S.C. §102 as being unpatentable in view of Burton et al., US Patent Publication 2003/0074527 published on April 17, 2003, hereinafter Burton.

The present invention, as set forth in representative claim 1 comprises in part:

1. A method for enabling parity declustering in a balanced parity array of a storage system, where an operating system performs the method comprising the steps of:

combining a plurality of unbalanced stripe arrays to form the balanced array, each unbalanced stripe array having parity blocks on a set of storage devices that are disjoint from a set of storage devices storing data blocks; and

distributing assignment of storage devices to parity groups throughout the balanced array.

By way of background, Burton describes system for determining the configuration of a logical array. The system includes spans made up of hard disk drives, where the hard disk drives store the parity and data. In Burton, the configuration is accomplished by the user using a configuration tool on a graphic user interface. The configuration tool shows if each span of the array has the same number of disks, a condition which Burton calls "balanced." The user can set an unbalanced configuration by setting a specific number of disks to one span thereby creating spans with different number of disks.

Applicant respectfully urges that Burton does not show Applicant's claimed novel step of *combining a plurality of unbalanced stripe arrays to form the balanced array* and *distributing assignment of storage devices to parity groups throughout the balanced array.*

In the present specification a balanced arrays is defined as :

The balanced array may be constructed by combining a plurality of unbalanced parity stripe arrays, each having parity blocks on a set of storage devices, such as disks, that are disjoint from the set of disks storing the data blocks. The novel parity assignment technique distributes the assignment of disks to parity groups throughout the combined super-stripe array such that all disks contain the same amount of data or parity information. Moreover, the inventive technique ensures that all surviving data disks of the array are loaded uniformly during a reconstruction phase after a single or double disk failure. (Specification page 11, line 25 to page 12, line 3)

When the stripe is repeated multiple times across the disks, the disks are filled uniformly and, accordingly, all the disks may be of the same size, thereby providing a balanced array. Notably, the array 700 is balanced after one repetition of a stripe. (Specification page 23, lines 21-23)

Fig. 10 is a block diagram illustrating such a balanced array configuration 1000 adapted for large write operations. (Specification page 24, lines 21-22)

Fig. 11 is a schematic block diagram illustrating the parity assignment technique of the present invention as applied to a large balanced array 1100 constructed in accordance with Figs. 9 and 10. The balanced "super-stripe" array 1100 comprises 25 disks, 20 of which are data disks and 5 of which are parity disks. Declustering can be achieved by changing the grouping of the 20 data disks into two groups of 10 data disks in each occurrence of the parity assignment pattern. For example, assume one parity group is "red" (R) and the other is "green" (G). The data (blocks) disks of the array are organized such that different blocks are logically participating in different parity sets from stripe to stripe across the array. In this context, parity declustering involves adding disks to a disk array without increasing the parity set size in such a way that the blocks associated with the parity sets are distributed as uniformly as possible across the rest of the disks of the array. (Specification page 25, line 27 to page 26, line 9)

It can be shown that three arrays, each having two disks, can be combined into a 6-disk balanced array wherein the association of the data disks to parity groups may be "juggled" from stripe to stripe. By juggling this association, the number of times each surviving disk is accessed (hit) during reconstruction of a lost disk is equal and balanced across the surviving disks of the array. (Specification page 29, lines 14-18)

Burton simply tries to balance i.e. make equal the number of disks in each span. In sharp contrast, Applicant's claimed invention balances the data and parity to optimize the workload for reconstruction.

Applicant respectfully urges that the Burton Patent is legally precluded from anticipating the claimed invention under 25 U.S.C. §102 because of the absence from the Burton patent of Applicant's *combines a plurality of unbalanced stripe arrays to form the balanced array and distributing assignment of storage devices to parity groups throughout the balanced array.*

§103 Rejection

At page 10, Examiner rejected claims 2 and 4-6 under 35 U.S.C. §103(a) as being unpatentable over Burton in view of US Patent No. 5,862,158 issued to Baylor et al. (hereinafter Baylor).

At page 11, Examiner rejected claims 7 and 13 under 35 U.S.C. §103(a) as being unpatentable over Burton in view of Baylor in view of US Patent No. 3,993,862 issued to Karr.

Applicant respectfully notes that claims 2, 4-7, and 13 are dependent claims that depend from independent claims which are believed to be in condition for allowance. Accordingly claims 2, 4-7, and 13 are believed to be in condition for allowance.

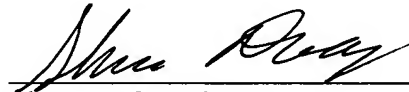
All independent claims are believed to be in condition for allowance.

All dependent claims are believed to be dependent from allowable independent claims, and therefore in condition for allowance.

Favorable action is respectfully solicited.

Please charge any additional fee occasioned by this paper to our Deposit Account
No. 03-1237.

Respectfully submitted,



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